



Mount Desert Island
Biological Laboratory

P.O. Box 35 159 Old Bar Harbor Road
Salisbury Cove, ME 04672
Main tel: 207-288-3605
fax: 207-288-2130
website: www.mdibl.org

Stu Markoon
Lamoine Town Office
606 Douglas Highway
Lamoine, ME
04605

Dear Stu,

May 15, 2012

Enclosed is a copy of a DEP application that we have submitted in order to conduct a small scale eelgrass experiment in Berry Cove. There is an attached research proposal that explains all of the parameters of the experiment. In short, we plan to look at the effects of slow release nutrients on the growth of eelgrass in the area. If we see a positive effect, we may use nutrients to jump-start transplanted eelgrass in all of our restoration areas in upper Frenchman Bay. As you may know, Berry Cove was full of eelgrass 15 years ago. Mostly due to dragging, eelgrass is nearly completely gone from the area, with the exception of a few meager patches. We aim to enhance these patches and transplant additional eelgrass from Hadley Point to Berry Cove this summer. We will document everything from water quality to colonization of the new eelgrass by invertebrate and fish species. Local mussel harvesters have been cooperative in not dragging in our restoration areas in the past, and we anticipate that they will respect the boundaries of our Berry Cove research area. If you have any questions, let me know!

Sincerely,

Jane E. Disney, Ph.D.
Staff Scientist
Director, Community Environmental Health Laboratory
jdisney@mdibl.org



Maine Department of Environmental Protection

**General Application for
Waste Discharge License (WDL) /
Maine Pollutant Discharge Elimination System (MEPDES) Permit**

Regulatory requirements for the preparation and filing of applications may be found in Chapters 2, 521 and 522 of the Department's rules.

GENERAL INSTRUCTIONS

1. This general form is to be used to make application for the discharge of pollutants to the surface waters of the State, from all source except from privately owned discharges subject to the Over Board Discharge Program requirements.
2. Applicants are responsible for publishing public notice of their application at the time it is filed with the Department. See pages 7 and 8.
3. For a proposed new discharge of wastewater of more than 25,000 gallons per day or a project involving licenses from more than two bureaus in DEP, an applicant must conduct a public informational meeting before submitting an application to the Department. See page 7.
4. In some circumstances an applicant must have a pre-application or pre-submission meeting with the Department prior to filing of an application. See page 9.
5. At the time an application is filed with the Department, a copy must be provided to the municipal office and notice provided to all abutters by certified mail. See page 7.
6. Application fees must be paid at the time an application for a **new** discharge or permit is filed. Contact the Department for additional information and calculation of the fee amount. For existing discharges, fees are charged on an annual basis and application fees are not required with an application for permit renewal.
7. Attach additional sheets as necessary in answering specific questions. Be sure to number each sheet to identify the question to which it pertains.
8. Failure to fully complete all required forms or to pay necessary application fees will result in the application being returned.
9. After completing the application, submit 2 copies to:

Maine Department of Environmental Protection
Bureau of Land and Water Quality
Division of Water Quality Management
State House Station 17
Augusta, Maine 04333-0017

10. Please read the entire application form before furnishing any information. If you need any assistance in filling out the form or required attachments, please contact the Department at the above address or by calling (207) 287-3901.

Assigned Project Manager: Gregg Wood Telephone: 207-287-7693

Maine Department of Environmental Protection
General Application for WDL / MEPDES Permit

This application is for a:

☒ New discharge ☐ Renewal ☐ Increased discharge ☐ Transfer of owner ☐ Modification ☐ Other: _____

If assigned: MEPDES#: ME _____ WDL #: W- _____ - _____ - _____

FACILITY AND APPLICANT INFORMATION

1. Facility Information (911 Address):

Facility Name: Berry Cove Receiving Water Name(s): _____
Town: _____ State: _____ Zip: _____
Global Positioning System (GPS) reference data if available _____
Facility Type: ☐ Federal ☐ State ☐ Other Public ☐ Private ☐ Other _____

2. Applicant Information:

Name: MDI Biological Laboratory Telephone: _____
Address: _____ e-mail: _____
Town: _____ State: _____ Zip: _____

3. Owner Information (if different from Applicant):

Name: Same as #2 Telephone: _____
Address: _____ e-mail: _____
Town: _____ State: _____ Zip: _____

4. Operator Information (if different from Applicant/Owner):

Name: Same as #2 Telephone: _____
Address: _____ e-mail: _____
Town: _____ State: _____ Zip: _____

NOTE: If a wastewater treatment facility is operated under a contract with third party, the contract for services must be reviewed and approved by the Department.

5. Cognizant Official (Person to whom correspondence regarding this application should be sent):

Name: Jane Disney Telephone: _____
Address: Po Box 35 e-mail: _____
Town: _____ State: _____ Zip: _____

6. Person in responsible charge of the treatment facility operations:

Name: Jane Disney Telephone: _____
Operator's license #: N/A Grade: _____ Professional Engineer? _____

7. Briefly describe nature of business and activities requiring WDL /MEPDES Permit:

(See attachment)

ELECTRONICALLY SIGNED DECISIONS

8. Electronically signed decision options. To expedite processing of applications and reduce paper usage, **all final decisions on an application will be electronically signed by the Commissioner (or his/her designee) and will be sent to the respective e-mail addresses provided for the Applicant and the Cognizant Official** listed on this application, unless the "opt out" signature block is signed below.

I hereby decline to receive an electronically signed decision on the WDL/MEPDES permit via e-mail and choose to receive manually signed (hand written) decision via regular (U.S. Postal) mail.

Sign to **DECLINE** only

(Applicant): _____ Date: _____

SUPPORTING MATERIALS AND REQUIRED ATTACHMENTS

9. For **new and transfer applications only** from privately-owned facilities, include: *N/a*

- ☐ A Certificate of Good Standing issued by the Maine Secretary of State.
- ☐ Proof of Title, Right or Interest (TRI) in the property on which the treatment system and outfall pipes and structures are or will be located. See Chapter 2 of the Department's rules for TRI criteria.

10. For **transfer applications only**, answer the following then skip to the Certification on page 6. *N/a*

- A. Name of current/former owner: _____
- B. Describe any planned changes in the current discharge: _____
- C. Provide a statement describing the technical and financial capacity to comply with the current permit conditions and applicable laws and rules.

11. Unless submitted previously and there have been no changes, provide a topographic map (or other map if a topographic map is unavailable) extending one mile beyond the property boundaries of the source, depicting the facility and each of its intake and discharge structures (showing latitude and longitude to the nearest 15 seconds), each of its hazardous waste treatment, storage, or disposal facilities; each well where fluids from the facility are injected underground; and those wells, springs, other surface water bodies, and drinking water wells listed in public records or otherwise known to the applicant in the map area.

See attachment

12. If modification of an existing permit is being requested, attach a statement describing the nature of the modification and the reasons or circumstances necessitating the change. Include any relevant modified process flow schematics available.

N/a

Maine Department of Environmental Protection
General Application for WDL / MEPDES Permit

13. Attachments for specific activities and circumstances. For each specific question, check 'Yes' or 'No' to indicate if the statement is applicable to a discharge or activity described in this application. Where 'Yes' is checked, attach the applicable form.

Specific Question	Yes	No	Applicable Form
A. Is this facility a publicly owned treatment works treating sanitary wastewaters?		✓	DEP Form: Publicly Owned Treatment Facilities (DEPLW0106)
B. Does this application seek authorization to introduce septage into treatment works?		✓	DEP Form: Disposal of Septage and Holding Tank Wastes in Wastewater Treatment Facility (DEPLW0507-A2004)
C. Is this application for a subsurface wastewater disposal system?		✓	DEP Form: Application for Subsurface Wastewater Disposal System (DEPLW0313-B2005)
D. Is this application for a land surface (including spray irrigation) wastewater disposal system?		✓	DEP Form: Application for Surface Wastewater Disposal System (DEPLW0450-B2005)
E. Is this a food processing facility or POTW that treats food processing wastewaters?		✓	DEP Form: Food Processing Facilities (DEPLW1999-19)
F. Is this an existing discharge of industrial process wastewater?		✓	EPA Form: 2C
G. Is this to be a new discharge of industrial process wastewater?		✓	EPA Form: 2D
H. Is this a discharge of non-contact cooling water?		✓	EPA Form: 2E
I. Is this discharge of storm water associated with an industrial activity?		✓	EPA Form: 2F
J. Is this a discharge of non-process wastewater?		✓	EPA Form 2E
K. Is this application for an Atlantic salmon net pen facility?		✓	DEP Form: Supplemental Information for Atlantic Salmon Aquaculture Net Pen (for Individual Permit) (DEPLW0956)
L. Is this a fish hatchery or rearing facility?		✓	DEP Form: Fish Rearing Facilities (DEPLW1999-18)
M. Is this an application for the use of aquatic pesticides?		✓	DEP Form: Aquatic Pesticides (DEPLW-141-A99)
N. Does this application involve a new or modified outfall structure?		✓	DEP Form: Outfall Information (DEPLW1999-17)
O. Is this application for a waste snow dump?		✓	DEP Form: Supplemental Information for Snow Dumps (DEPLW0249)

OUTFALL AND TREATMENT INFORMATION

Use attachments as necessary to provide details for each discharge point and treatment system.

14. Describe each discharge location. Include all combined sewer overflow (CSO) points, bypasses, emergency discharge points, etc.

Outfall Number/Name

Description, Volume Discharged and Receiving Water

N/a

If any of the above-listed discharges (other than CSOs) are intermittent or seasonal, please describe the nature, circumstances and duration of each.

15. Briefly describe current treatment facilities or methods for each discharge.

(See attachment)

16. If this is a renewal application, please describe all significant modifications to the treatment facilities (and collection system if applicable) since the last permit application was filed.

N/a

17. Are new or expanded treatment facilities or outfall structures being proposed? ____ If so, please include a construction schedule. Plans and specifications must be submitted to the Department for review and approval prior to construction of the facilities.

N/a

18. If this application is for a new or increased discharge, include a statement that:

- A. describes in detail the nature of and reason for the requested increase in pollutant loading to the receiving water;
- B. if the Department determines that the discharge will diminish the remaining assimilative capacity of the receiving water, demonstrates that alternative methods to reduce or eliminate the increased discharge are not feasible. Include engineering and economic analyses that consider alternative methods of production, process controls, wastewater minimization methods, improved wastewater treatment methods and alternate disposal sites; and
- C. if the Department determines that the discharge will diminish the remaining assimilative capacity of the receiving water, demonstrates that the increased pollutant load will result in important social and economic benefits to the State.

(See attachment)

Maine Department of Environmental Protection
General Application for WDL / MEPDES Permit

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Additionally, by signing below, I certify that

(1) notice of this application has been made by publication in Bangor Daily News
name of newspaper

newspaper circulated in the area where the project site is located on or about 5/16/2012 (a copy of the advertising form is included in this application); (2) notice has been sent by certified mail or Certificate of Mailing to owners of land abutting the discharge site (a copy of the list of abutters is N/a included in this application); and (3) notice and a copy of this application have been provided to the clerk of the municipality(ies) where the discharge is located. (4) Further, if this is a new discharge over 25, 000 gallons per day, a public meeting attended by approximately _____ members of the public was held on _____ N/a

The foregoing steps have been taken in accordance with the instructions attached to this application and the provisions of Chapters 2 and 522 of the Department's rules.

By:

Signature: _____

Printed Name: _____

Title: _____

Jane E. Disney

Jane E. Disney

Staff Scientist, MDI Biolab

Date: _____

5/15/2012

Assisting Parties. If the applicant has been assisted in preparing this application, the person assisting must sign below.

Signature: _____

Date: _____

Printed Name: _____

Telephone: _____

Affiliation: _____

Address: _____

Town: _____

State: _____

Zip: _____

Professional Registration or Certification: _____

See following pages for requirements on public notice, public meetings, pre-applications meetings and pre-submission meetings.

Instructions for providing notices of the application. For all applications, the first 3 items must be completed. If the application is for a new discharge, you must also complete item 4.

1. *Publication of Public Notice.* Applicants for waste discharge permits are required to publish a public notice that the application is being filed with the Department of Environmental Protection. The notice must be published within 30 days prior to the application being sent to the Department. The notice should be published in the legal advertisement section of a daily or weekly newspaper having general circulation in the area where the discharge will occur. If the public notice is not published at the proper time or if the application is returned because it is incomplete, you may be asked to have the notice published a second time.

Using the form on the next page, fill in the blanks with the appropriate information. Strike out all of the items (CSO, multiple discharge sources, etc.) in the second paragraph that do not apply to your discharge. The form may then be sent to the newspaper that is to publish the notice. Additionally, include a copy of the form with the application filed with the Department.

2. *Notice to Abutters.* Applicants are also required to send a copy of the public notice by certified mail or Certificate of Mailing to all abutting property owners within 30 days prior to the application being filed with the Department. For the purposes of public notice of this application, an "abutter" is any person who owns property that is both (1) adjoining and (2) within 1 mile of the delineated project boundary, including owners of property directly across a public or private right of way. Additionally, include a copy of the form with the application filed with the Department.

3. *Notice to Municipal Office.* Applicants are required to send a copy of the public notice by certified mail to the town or city clerk of each municipality where the discharge is located within 30 days prior to the application being filed with the Department. Applicants must also file a duplicate copy of the application with each municipality.

4. *Public Meeting.* Where the application is for a new discharge of greater than 25,000 gallons per day, you must hold a public meeting in accordance with Chapter 2, Section 8, of the Department's rules. Notice of the meeting must be sent to abutters and the clerk of the municipality(ies) where the discharge is located at least 10 days prior to the meeting. Notice of the meeting must be published in the same newspaper used to publish the notice of filing.

After all required notices have been made, sign the statement on the Certification page of the application.

Maine Department of Environmental Protection
General Application for WDL / MEPDES Permit

NOTICE OF INTENT TO FILE
MAINE WASTE DISCHARGE LICENSE / MAINE POLLUTANT DISCHARGE ELIMINATION
SYSTEM PERMIT APPLICATION

notice
attached

Please take note that, pursuant to 38 MRSA, Sections 413 and 414-A, _____ of _____
(name)
_____ intends to file a wastewater discharge permit application with the Department of
(address)
Environmental Protection (DEP). The application is for the discharge of _____ of _____
(volume)
_____ to the _____ in _____, Maine.
(describe waste source) (receiving water) (municipality)

Include as applicable:

CSO: Included in this application is the discharge from _____ Combined Sewer
(number of points)
Overflows to _____
(list all receiving water)

Multiple industrial point sources: The application includes _____
(describe all additional or secondary point sources)
associated with the primary activity described above.

Antidegradation: The application proposes a new or increased discharge that may lower existing receiving water quality within its legal classification, and the application contains a statement regarding important social and economic benefits resulting from the activity causing the discharge, pursuant to 38 MRSA, Section 464.

Mixing Zone: The application includes a request for establishment of a mixing zone in the _____, inside of which classifications standards and uses not need to be met,
(receiving water)
pursuant to 38 MRSA, Section 451.

The application will filed on or about _____ and will be available for public inspection at DEP's
(date)
Augusta office during normal business hours. A copy may also be seen at the municipal offices in _____
(municipality)

A request for a public hearing or request that the Board of Environmental Protection assume jurisdiction over this application must be received by the DEP, in writing, no later than 20 days after the application is found acceptable for processing, or 30 days from the date of this notice, whichever is longer. Requests shall state the nature of the issue(s) to be raised. Unless otherwise provided by law, a hearing is discretionary and may be held if the Commissioner or the Board finds significant public interest or there is conflicting technical information.

During the time specified above, persons wishing to receive copies of draft permits and supporting documents, when available, may request them from DEP. Persons receiving a draft permit shall have 30 days in which to submit comments or to request a public hearing on the draft.

Public comment will be accepted until a final administrative action is taken to approve, approve with conditions or deny this application. Written public comments or requests for information may be made to

the Division of Water Quality Management, Department of Environmental Protection, State House Station #17, Augusta, Maine 04333-0017. Telephone (207) 287-3901.

Pre-application and pre-submission meetings

Pre-application meetings. Pre-application meetings between the applicant and the Department are an opportunity for the applicant to determine the statutory and regulatory requirements that apply to a specific project and to identify a Project Manager for the application. The purpose of these meetings is to identify issues, processing times, fees and the types of information and documentation necessary for the Department to properly assess the project. The applicant shall consult the appropriate bureau Permit Assistance Coordinator to determine what information the applicant must provide before or during a pre-application meeting. Any applicant may request a pre-application meeting. The Department shall make a date available for the meeting as expeditiously as possible, but no later than 30 days from receipt of a written request and receipt of all information required for a pre-application meeting by the bureau. The Department shall prepare a written summary of all pre-application meetings.

For waste discharge permits, pre-application meetings are required prior to submission to or acceptance by the Department of an application for the following:

New wastewater discharge license for a discharge greater than 25,000 gallons per day (38 M.R.S.A. Sections 413, et seq.);

Projects requiring new or amended licenses involving more than two bureaus.

Pre-submission meetings. Pre-submission meetings between the applicant and the Department occur after the applicant has finished preparing the application for submission. These meetings are an opportunity to review the assembled application to ensure that the necessary information has been included prior to filing the application with the Department. An applicant may request a pre-submission meeting by contacting the Project Manager, or the Permit Assistance Coordinator for the bureau if no Project Manager has been identified. The Department shall make a date available for the meeting as expeditiously as possible, but no later than 20 days from receipt of a written request.

For waste discharge permits, a pre-submission meeting is required prior to submission to or acceptance by the Department of an application for the following:

Any application for which a pre-application meeting was held; or

Any application that has been previously rejected by the Department (see Chapter 2, Section 7-B of the Department's rules).

Waivers. The requirement of a pre-application or pre-submission meeting may be waived by written notice from the Department and agreement by the applicant. The Department will agree to waive a pre-application or pre-submission meeting if the Department is satisfied that such a meeting would be of no value in achieving the purposes noted above.

Note: The waiver of a pre-application or pre-submission meeting does not waive the public informational meeting required for new discharges of more than 25,000 gallons per day.

NOTICE OF INTENT TO FILE
MAINE WASTE DISCHARGE LICENSE / MAINE POLLUTANT DISCHARGE ELIMINATION
SYSTEM PERMIT APPLICATION

Please take note that, pursuant to 38 MRSA, Sections 413 and 414-A, Mt Desert Island Biological Laboratory of Bar Harbor intends to file a wastewater discharge permit application with the Department of Environmental Protection (DEP). The application is for the discharge of nutrients associated with an experimental project located in Berry Cove, Upper Frenchman's Bay, in Lamoine, Maine.

The application will be filed on or about May 15, 2012, and will be available for public inspection at DEP's Augusta office during normal business hours. A copy may also be seen at the municipal offices in Town of Lamoine.

A request for a public hearing or request that the Board of Environmental Protection assume jurisdiction over this application must be received by the DEP, in writing, no later than 20 days after the application is found acceptable for processing, or 30 days from the date of this notice, whichever is longer. Requests shall state the nature of the issue(s) to be raised. Unless otherwise provided by law, a hearing is discretionary and may be held if the Commissioner or the Board finds significant public interest or there is conflicting technical information.

During the time specified above, persons wishing to receive copies of draft permits and supporting documents, when available, may request them from DEP. Persons receiving a draft permit shall have 30 days in which to submit comments or to request a public hearing on the draft.

Public comment will be accepted until a final administrative action is taken to approve, approve with conditions or deny this application. Written public comments or requests for information may be made to the Division of Water Quality Management, Department of Environmental Protection, State House Station #17, Augusta, Maine 04333-0017. Telephone (207) 287-3901.

[Sent to Bangor Daily News 5/14/2012]

Enhancing Eelgrass Transplantation by Supplementing with Slow-release Nutrients

Contact Dr. Jane Disney, Director, Community Environmental Health Laboratory
Mt. Desert Island Biological Laboratory,
Box 35, Old Bar Harbor Rd., Salisbury Cove, ME 04672
Phone 207-288-9880 ext 423 Fax 207-288-2130 E-mail jdisney@mdibl.org

PROJECT DESCRIPTION

Background

Eelgrass (*Zostera marina*) is a unique flowering plant, formerly occurring in widespread meadows in sub-tidal areas along the coast of Maine. Its reproduction is both vegetative (spreading through rhizomes) and sexual (through the formation of seed). As one of the primary photosynthetic producers, it plays a crucial role in the ecology of the Gulf of Maine, including, Frenchman Bay in Hancock County, Maine. It oxygenates the water and particularly the mud in which it is rooted, removing the H_2S and allowing for growth of many marine invertebrates. It removes nitrates and phosphates from the water, improving water quality. Its roots stabilize the soil and prevent erosion by wave action. Eelgrass beds have a damping effect on waves, mitigating shoreline erosion of land areas adjacent to them. Eelgrass serves both as a food source for some organisms such as ducks, and as a substrate for the growth of other organisms such as epiphytic algae and epizootics (anemones, sponges, and bryozoans) which are themselves used as food by larger organisms. Perhaps of highest importance, eelgrass is a primary nursery for a significant number of larger fish such as winter flounder, striped bass, and Atlantic cod, providing shelter until they are large enough to escape predation risk in open waters. It serves as a settling site for organisms such as juvenile blue mussels, which benefit from being in the water column, filtering plankton through this crucial stage of their life cycle (1). Eelgrass beds may be the single most important key to the sustainability of fisheries in Frenchman Bay, not only enhancing mussel populations, but also populations of lobster (2), flounder, hake, pollock, striped bass and cod (3), as well as other smaller "bait" fishes such as herring, Atlantic silversides and mummichog.

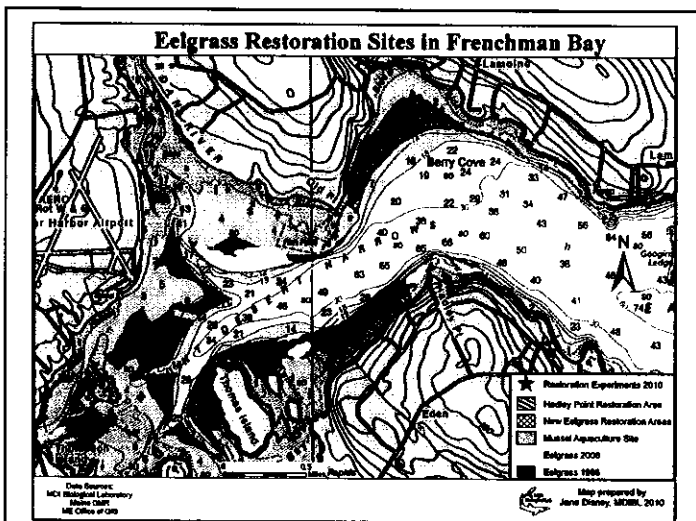


Figure 1. Upper Frenchman Bay: Depiction of historic and current eelgrass areas and eelgrass restoration sites. Berry Cove is the proposed site for nutrient enhancement studies.

Eelgrass has declined throughout the world in the past few decades. In most places, the decline is due to water quality issues. Eelgrass has experienced significant declines in Frenchman Bay as well (Compare 1996 areas depicted in green and the 2008 areas depicted in yellow in the map in Figure 1.) However, Frenchman Bay has excellent water quality; therefore, water quality declines do not explain the loss of eelgrass habitat here. Eelgrass decline is probably due to habitat disruption by harvesters who drag for mussels and other sessile species. At Hadley Point in upper Frenchman Bay, the bottom coverage was estimated at 60 - 80% cover in 1996, declining to <1 % in 2007. Over this period, commercial fish landings from the whole of Frenchman Bay have declined to the point where virtually no finfish are harvested (4), and sport fishing is likewise essentially gone (5). We predict that restoration of eelgrass meadows will have a beneficial effect on these

fisheries, although there will be a lag of many years as the young fish mature. Restoration of in-shore habitat, in our view, is one of the major components in restoration of healthy fish populations, not only in Frenchman Bay but in the Gulf of Maine as a whole.

Enhancing Eelgrass Transplantation by Supplementing with Slow-release Nutrients

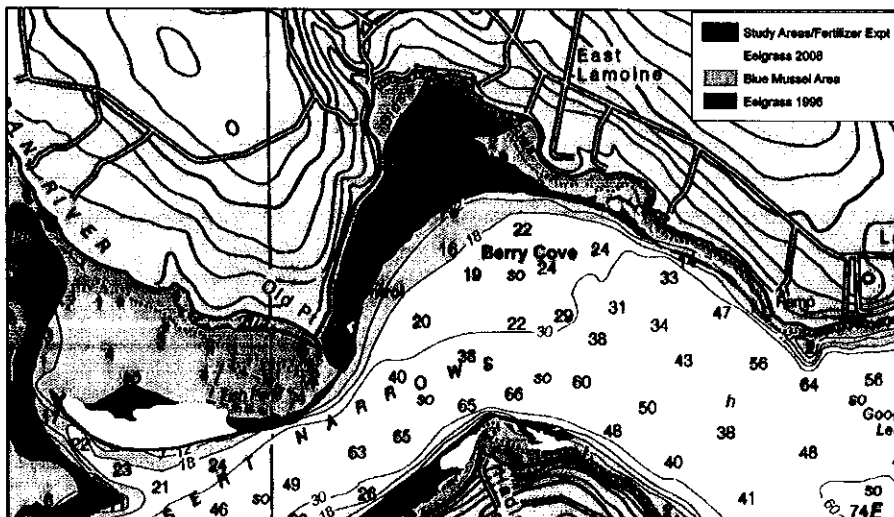
It is fortunate that water quality in the upper bay has not declined, despite the fact that much eelgrass disappeared between the 1996 and 2008 Maine DMR assessments. Restoration of eelgrass will help to mitigate potential future impacts on water quality, such as changing land use, and help to sustain good water clarity and quality in Frenchman Bay into the future.

Over the last five summers, MDIBL has worked in partnership with multiple community groups to restore eelgrass at Hadley Point. Our efforts to date have shown slow but steady progress. The coverage in our 14 acre restoration reserve increased from less than 1% in 2007 to approximately 14% by summer 2011. Moreover, while we have transplanted a total of about 75 square meters of eelgrass, a recent census shows 3500 square meters of coverage, nearly a 48-fold increase. In addition, new eelgrass patches have developed 1.5 miles across the bay in Berry Cove in Lamoine and along the Lamoine shoreline, and as far away as 7.5 miles out toward the mouth of the bay, near Bar Island, possibly due to seeding out of our site. We have anecdotal evidence that flounder, striped bass, cod, and pollock have discovered our new eelgrass areas (6), and data to show that juvenile mussels use restored eelgrass as a staging area before settling down in the intertidal zone as adults (7). We have worked closely with stakeholders to identify other priority areas for eelgrass restoration in upper Frenchman Bay. The priority areas include Berry Cove in Lamoine as well as the Thomas Bay area in Bar Harbor (8). We have negotiated for voluntary conservation agreements with local mussel harvesters in order to secure these areas for eelgrass restoration and research. These areas, when restored (114 acres total), have the potential to seed over a sub-tidal area of ~13,000 acres of potential eelgrass habitat in Frenchman Bay.

Project Proposal:

We are interested in enhancing plant growth in our restoration areas. Limiting factors for plant growth in sea water are nitrogen, phosphorous and iron. In the future it might be helpful to supply these nutrients to transplants in an effort to expedite their rooting and vegetative growth. *As a first step*, we need to determine if adding nutrients in a slow-release form into an eelgrass patch increases the rate of rhizome spread. At the same time, it will be important to determine if the addition of nutrients impacts water quality or stimulates algal growth in the area. As mentioned above, patches of eelgrass have appeared naturally in Berry Cove since the start of our restoration efforts at Hadley Point. Since this area historically had substantive eelgrass beds, this is a good area to test the effect of nutrient addition. We propose to add a slow-release nutrient ball containing nitrogen and phosphorus plus an iron spike to each of several patches of eelgrass, while leaving other comparable patches unfertilized, in order to evaluate the efficacy of enhancing eelgrass growth through slow release of nutrients to roots (Figure 2).

Berry Cove Fertilizer Experiment Area



1996 and 2008 Eelgrass Data
Seth Barker, Maine DMR
Mussel Area Data
ME Office of GIS

Map by Jane E. Disney
MDI Biological Laboratory
2012

Figure 2. A slow-release fertilizer system containing nitrogen and phosphorus will be added to 3-5 eelgrass patches within the areas indicated in the map. Some patches will also receive iron in the form of an iron spike, driven into the sediment. Some patches will receive the iron spike alone, and some patches will receive no treatment, serving as a control area. Berry Cove is located in the town of Lamoine in upper Frenchman Bay. The entire area in which there are eelgrass patches is 20 acres. The eelgrass coverage in 1996 (the green area in the cove in 1996) is 92 acres.

Enhancing Eelgrass Transplantation by Supplementing with Slow-release Nutrients

The addition of slow-release nutrients may enhance the growth and spread of eelgrass in these patches and help to inform future eelgrass restoration work in Berry Cove and elsewhere in the bay. Nutrient enhancement of transplants in other marine vegetative habitats (mangroves) has proved successful without impacting water quality (9). A study done by Robert Orth (10) demonstrated dramatic effect of commercial fertilizers on growth of eelgrass. This experiment used fertilizers in the sediment, but not a slow release system. However, this study did not measure nutrients in the water column or sediments.

Despite our success with eelgrass restoration at Hadley Point, we project that it will take at least until 2022 for a return to the density of eelgrass that was there in 1996, even with continued transplanting into the area (Figure 3).

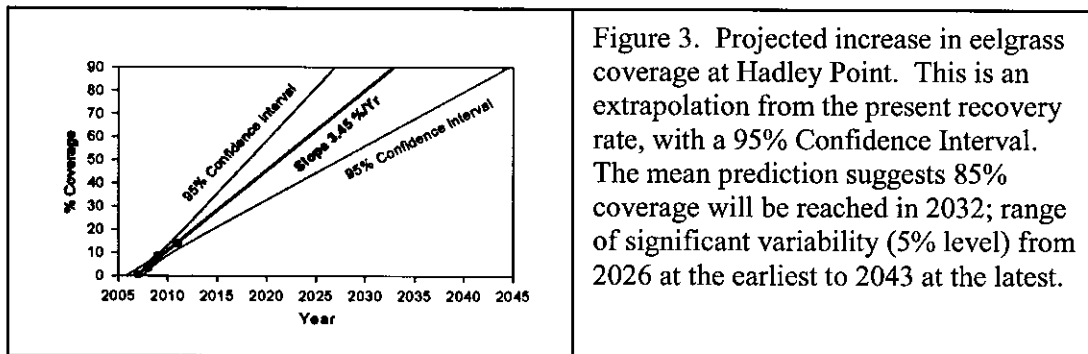


Figure 3. Projected increase in eelgrass coverage at Hadley Point. This is an extrapolation from the present recovery rate, with a 95% Confidence Interval. The mean prediction suggests 85% coverage will be reached in 2032; range of significant variability (5% level) from 2026 at the earliest to 2043 at the latest.

Enhancing the growth rate of transplants will:

- potentially enhance local fisheries of commercial importance
- cut down on the cost of doing restoration work
- increase the likelihood of attaining our goal of full eelgrass recovery in degraded areas
- inform eelgrass restoration efforts world-wide

We desire a healthy bay. Increased efficiency of eelgrass restoration, protection of the resource through voluntary agreements with draggers, and education efforts should lead to greatly expanded eelgrass coverage. This will be measured in the next aerial survey by Maine DMR, probably in about a decade. In the mean time, we will monitor coverage by several methods (see below) and track the expansion of eelgrass. We desire good water quality - low nitrate and phosphate values, low suspended sediments, high oxygen - these are good now and we propose to keep them good. Berry Cove has historically had an average nitrogen level of less than 2.0 μM and an average phosphate level of less than 0.6 μM (Figure 4). We will monitor for any signs of impact from our supply of nutrients or nutrients from other sources. We desire a sustainable fishery for a variety of species which used to be present in Frenchman Bay, and anticipate that with protection and good nursery availability, even cod (which recently have been seen as juveniles in the bay) will return as mature fish.

Enhancing Eelgrass Transplantation by Supplementing with Slow-release Nutrients

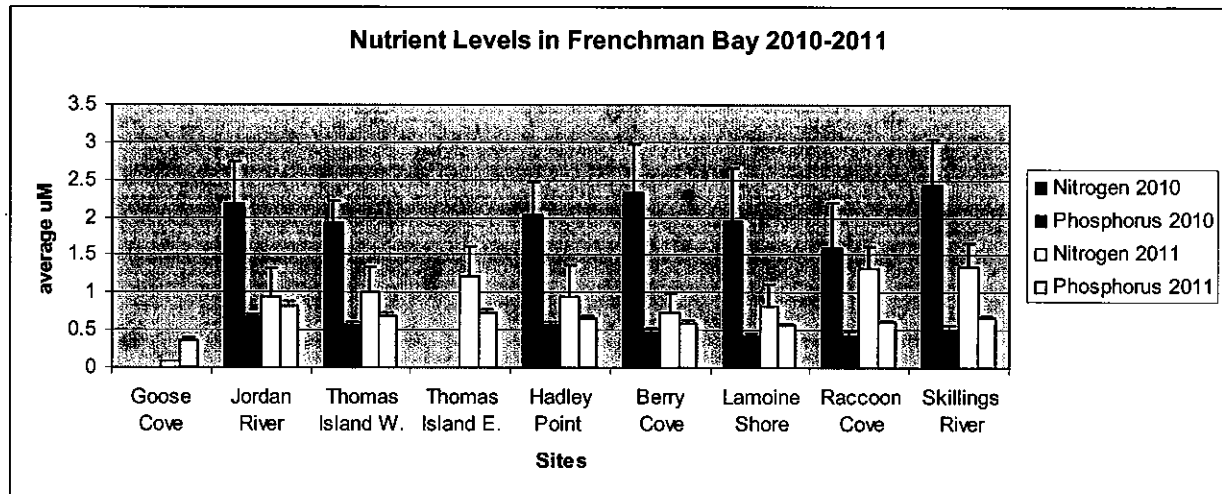


Figure 4. Triplicate water samples are taken for nitrogen and phosphorus one time in June, July, August and September. This graph represents the average nutrient levels over two years. The difference between 2010 and 2011 is largely due to a late season (September) spike in nitrogen levels throughout Frenchman Bay in 2010 that was not observed in September 2011. We did note an early die-back in eelgrass in 2010, which may be attributable to a hot end-of-summer. Eelgrass may itself contribute to nutrients in the bay as it dies back in the fall. So once eelgrass gets re-established, it may provide its own nutrient source in the cove.

Permits in-hand and requested: We currently have a Permit by Rule from the Maine DEP, and a Programmatic General Permit from the Army Corps of Engineers for activities related to eelgrass restoration. These include harvesting eelgrass, and placing grids with eelgrass transplants into Hadley Point, Berry Cove, and around Thomas Island in Thomas Bay. We seek any additional permits that are necessary to implement a limited-in-scale nutrient experiment in Berry Cove that may inform our future eelgrass restoration work in Frenchman Bay.

Collaboration: We are collaborating with Dr. Gordon Sato, who directs the Manzanar Project in Eritrea. He has been using nutrients to promote the success of mangrove transplants with amazing success, without impacting water quality (9).

WORK PLAN

Start and End Dates: May 2012-April 2013

Methodology:

Setting up the Study Area

We will choose 3-5 existing eelgrass patches in Berry Cove in four different treatment areas (slow release fertilizer ball with nitrogen and phosphorus plus 1 iron spike, slow release fertilizer ball with nitrogen and phosphorus without the iron spike, the iron spike only, and untreated, see Figure 2) for a total of 12-20 patches and mark each patch with a numbered PVC pole. We will choose to do 5 smaller patches or 3-4 larger patches depending on what is available in our study site. Each patch will be photographed at the start of the study. We will set up 1 marker buoy in close proximity to each treatment area at which water samples will be taken. The nutrient ball and fertilizer spike will be tethered to the marker pole, and can be removed before the conclusion of the study if deemed necessary.

Enhancing Eelgrass Transplantation by Supplementing with Slow-release Nutrients

Preparation of Slow-Release Nutrient Balls

The slow release nutrient ball (as designed) weighs approximately 1470 g, and contains 230 g (8 oz) of urea and 230 g (8 oz) of Di-Ammonium Phosphate, with the balance being approximately 900 grams (2lbs) of gypsum and approximately 110 grams (4 oz) of cement. These ingredients are mixed with enough water to form a ball inside a plastic mold. Each nutrient ball is sufficient to fertilize plants in a 2 meter-square area. When dry, the ball is removed from the mold. A 10 inch, 245 g iron spike will be used as a slow-release source of iron in sediments. The ball dissolves at a rate of approximately 21 grams per day. So the release of nitrogen and phosphorus is approximately 5 grams per day (about a teaspoon) (Figure 5).

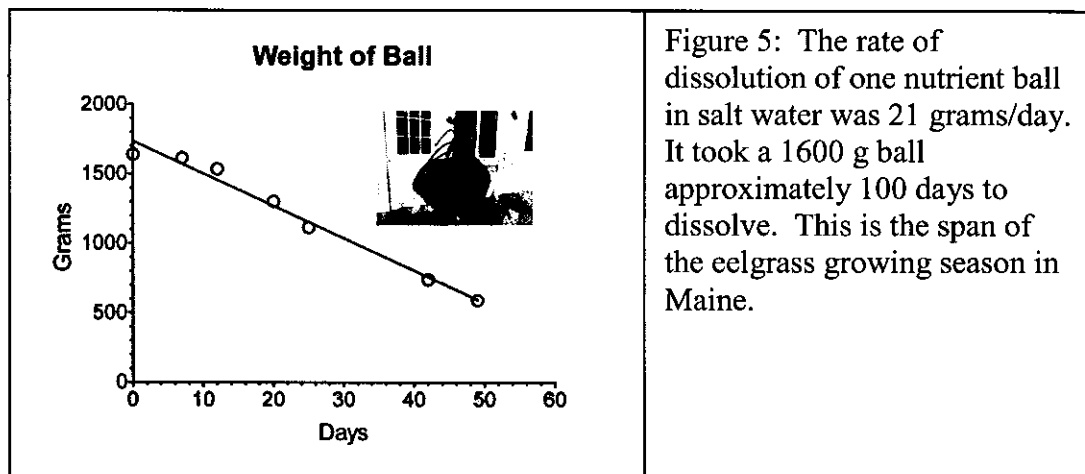


Figure 5: The rate of dissolution of one nutrient ball in salt water was 21 grams/day. It took a 1600 g ball approximately 100 days to dissolve. This is the span of the eelgrass growing season in Maine.

Conservation Agreements

We currently have a *voluntary marine conservation agreement* with the Maine Mussel Harvester's Association in which local draggers have agreed to avoid dragging in our research and restoration areas, including the site of this proposed study, the western end of Berry Cove.

Monitoring

We plan to monitor for parameters that assess the effect of nutrient supplements in eelgrass patches. These include both parameters to assess structural characteristics and parameters to assess functional characteristics of the eelgrass patches:

Parameters to assess structural characteristics:

We will measure patch size, percent coverage of eelgrass, plant height and stem density in each patch before and each month after introduction of a slow-release nutrient ball. We will measure temperature, dissolved oxygen, nitrogen, phosphorous and salinity in order to assess water quality before and after nutrient application. We will measure settleable solids and turbidity in order to assess water clarity within the study area. Our plan is to monitor at one week and then each month from project initiation through September 2012. We will have sediment analyzed before and after the experiment.

Eelgrass acreage will be determined at the end of the project by direct measurement of eelgrass patches within the study area. This is accomplished with people in the water, measuring eelgrass patches with measuring sticks. *Eelgrass stem density* will be measured at first by counting all stems in the patch and

Enhancing Eelgrass Transplantation by Supplementing with Slow-release Nutrients

dividing by patch size. If patches grow so large as to make this assessment method too laborious, density will be determined by randomly throwing a .25 m² quadrat into the patch; plant density within three replicate quadrats will be assessed in each patch. *Plant height* will be measured by randomly choosing three vegetative shoots within the patch or within the .25m² quadrats and measuring the blade length.

Water quality variables will be monitored by obtaining monthly (May-September) water samples in the study area. We have two years of data on water quality in Berry Cove that we will use as a baseline for comparison (Figure 2). The Community Environmental Health Laboratory at MDIBL has a Quality Assurance Project Plan approved by Maine DEP, that will be updated this summer, for assessing an array of water quality variables. Sites will be analyzed for nitrogen, phosphorus, turbidity, settleable solids, dissolved oxygen, salinity, and temperature. We will be working closely with Clarissa Trasko from Maine DEP to assure that best methods are used in assessing these variables. It is anticipated that each of these parameters will be comparable to those obtained at Berry Cove between 2010 and 2011. We expect pre-and post water quality monitoring to reveal nitrogen levels < 2 uM, phosphorus levels < 1uM, settleable solids near zero, turbidity < 2.0 NTU, oxygen >6 ppm, and salinity well above 10 ppt (the lower limit tolerable for eelgrass). We anticipate that temperature will fluctuate with tide stage and time of year. In addition, we plan to examine the species composition of the phytoplankton community in Berry Cove. We are currently participants in the Maine Volunteer Phytoplankton Monitoring Program and have years of data on phytoplankton in upper Frenchman Bay. We will compare the make-up of phytoplankton assemblages in Berry Cove with those we are examining elsewhere in Frenchman Bay, including the Bar Harbor Town Pier and at the MDIBL dock in Salisbury Cove. We will visually inspect eelgrass blades for epiphytes and the study area for the presence of *Ulva intestinalis*.

Sediment cores will be taken from each of the 3-5 patches in each study area before the addition of nutrients and at the end of the experiment in September. The cores from each study area will be consolidated into one Ziploc bag for a total of four consolidated samples and sent to the Analytical Lab and Maine Soil Testing Service care of Bruce Hoskins at the University of Maine. Each consolidated sediment sample will be tested for iron, phosphorus, boron, copper, magnesium, zinc, nitrogen and ammonia.

Parameters to assess functional characteristics:

We plan to measure several parameters that will assess the functional characteristics of the eelgrass area. In addition to measuring acreage, % coverage, plant height, and stem density, we will be conducting surveys of faunal populations (fish and invertebrate colonizers of the eelgrass blades). *Faunal populations* will be monitored in a variety of ways. In order to get an idea of the whether eelgrass fertilized by added nitrogen, phosphorus, and iron might be having an affect on the epibenthic communities in our study site, we will be conducting fish surveys. We will set fish traps in eelgrass patches treated with fertilizer and eelgrass areas not treated with fertilizer and examine their contents every 2-5 days over a 30 day period during the summer. Fish and other macroscopic fauna within them will be identified, measured and released. If a fish or invertebrate cannot be immediately identified, it will be photographed for future identification. *Invertebrate colonizers* will be assessed by randomly collecting the outer eelgrass blades from six eelgrass plants within the fertilized eelgrass patches and unfertilized eelgrass patches in May-September 2012 and identifying and enumerating all invertebrates associated with the blades.

Anticipated Outcomes:

Based on previous research in which slow release (NPK) fertilizer added to colonizing eelgrass patches did not increase nutrients in the water column (11), we expect water quality in our study areas will not be negatively impacted during the course of our proposed experiment. Although this research did not reveal a significant difference between growth and spread of plants in fertilized vs. control plants, the rate of release of fertilizer was slower than we anticipate with our nutrient balls, therefore, we expect to see a growth response in our study areas.

Enhancing Eelgrass Transplantation by Supplementing with Slow-release Nutrients

We have years of data on invertebrate colonizers on eelgrass blades at Hadley Point and near Bar Island in Bar Harbor. We anticipate that we will have a similar distribution of invertebrate species on eelgrass that has been fertilized as on eelgrass from unfertilized patches in Berry Cove and eelgrass from other sites.

Timeline

May 2012 Mark test patches with stakes. Conduct pre-experiment monitoring of water quality, sediments, and assessments of phytoplankton, invertebrate and fish species.

May or June 2012 Add one slow-release nutrient ball and iron spike to assigned patches. Collect water quality one week post-placement of nutrients and each month thereafter.

May or June 2012-September 2012, Conduct monthly post-experiment monitoring of water quality and assessments of phytoplankton, invertebrate and fish species.

April 2013-April 2016, Continue annual monitoring of nutrients, growth of eelgrass, and use of the eelgrass area by invertebrate and vertebrate species.

Goals

- Goal 1: Improve eelgrass growth and spread through addition of slow-release nutrients to existing patches as a demonstration of the efficacy of using slow-release nutrients to improve eelgrass restoration capabilities in the future.
- Goal 2: Determine the ability of fertilized eelgrass to provide ecosystem services and functions.
- Goal 3: Demonstrate that slow-release nutrients will not impact water quality or clarity.

References

1. Nedeau, E. Extraordinary Eelgrass Wildlife Journal 2004
2. Short, F. T., K. Matso, H. M. Hoven, J. Whitten, D. M. Burdick and C. A. Short. 2001. Lobster use of eelgrass habitat in the Piscataqua River on the New Hampshire/Maine Border, USA Estuaries and Coasts Volume 24:277-284
3. Gotceitas, V, S Fraser, and J.A. Brown. 1997. Use of eelgrass beds (*Zostera marina*) by juvenile Atlantic cod (*Gadus morhua*) Can. J. Fish. Aquat. Sci. 54:1306–1319 (1997)
4. 2010 Landings Data from Maine DMR reveal that <0.5% of the value of marine resources harvested in the Frenchman Bay area is from finfish harvest.
5. Phil Corson, local lobsterman and member of our upper Frenchman Bay stakeholder group recalls an active striped bass fishery 10-12 years ago, personal communication.
6. There are hints of recovery of some fish species since 2007. Mature flounder, for instance, have been caught in local lobstermen's traps for the first time in many years, and young cod have been sighted by recreational divers in eelgrass beds in Bar Harbor.
7. Disney, J.E. Kidder, G.W., Balkaran, K., Brestel, C. and Brestel, G. 2011 Blue mussel (*Mytilus edulis*) settlement on restored eelgrass (*Zostera marina*) is not related to proximity of eelgrass beds to a bottom mussel aquaculture lease site. Bulletin Mt. Desert Island Biological Laboratory 50: 80-82
8. A stakeholder meeting was held on March 30, 2010 by MDI Bio Lab to prioritize eelgrass restoration sites and discuss the future of Frenchman Bay; 36 persons with interests in the bay, from landowners to fishermen to state officials were in attendance.
9. Sato, G. et al., (2005) A Novel Approach to Growing Mangroves on the Coastal Mud Flats of Eritrea with the Potential for Relieving Regional Poverty and Hunger. Wetlands 25: 776-779.
10. R. Orth, Nutrient Enrichment of Eelgrass Marine Biology 44 187-194 (1977).
11. B. Worm and T. Reusch: Do nutrient availability and plant density limit seagrass colonization in the Baltic Sea? Marine Ecology Progress Series Vol. 200, 159-166, 2000